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ABSTRACT

This volume contains a series of papers which develop multidisciplinary environmental education activities in seven subject matter areas: political science, health education, language or communication arts, art, science, mathematics, and social studies. Different formats are used for organizing the materials in each of the different subject areas. General outlines for the teacher are provided for the political science, health education, communication arts, mathematics, and social studies units. Sample materials to be used for student activities are included for health education (elementary and secondary levels), communication arts (elementary and secondary), art (elementary and secondary), science (elementary), mathematics (secondary and intermediate), and social studies (elementary). (DT)

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MULTIDISCIPLINARY ENVIRONMENTAL EDUCATION ACTIVITIES

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SE 017 816

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INTRODUCTION

The Florida Department of Education commissioned a series of papers to develop multidisciplinary environmental education activites in specific subject matter areas.

These papers were commissioned with:

John DeGrove for Political Science
Wynn F. Updike for Health Education
Herb Karl for Language or Communication Arts
George Pappas for Art
Lehman Barnes for Science
Ernest Burgess, Jr. for Mathematics
Irene Clark for Social Studies

These persons were asked to develop an intellectual framework for teaching their particular discipline within an environmental context. No specific format or direction was given; each scholar was encouraged to develop his own style and approach to the problem. The following activities resulted from this effort.

It is hoped that this volume and its companion volume, Strategies for Multidisciplinary Environmental Education will serve as a useful tool in curriculum development projects in Florida and other states.

POLITICAL SCIENCE ACTIVITY
By
John DeGrove

Case studies are marvelous teaching tools for they address the student as an active participant in the material being studied rather than just the traditional passive member of a classroom. Therefore, independent, constructive, thinking is as much a part of the learning process as the assimilation of facts. This independent thinking is an essential ingredient to the sound operation of a case study method of study.

The case method does two things for the student:

1) It provides the student with information which makes them think purposefully. That is, they are not given general theories or hypotheses to criticize; rather, they are provided with specific facts and raw materials on which decisions are based in real life which they too can realistically and usefully draw their own conclusions.

2) Student participation is achieved by the opening of free channels of communication between student and student and between students and their teachers.

Since there are no real answers, the requirement is to be able to base an argument or a belief with a logical order of facts and raw data. It puts upon the student the burden of independent thinking.

A student participating in a case method study should realize that he need not memorize all the data. The case should be first read over lightly to get a general idea of the case at hand. He should then read the case more carefully and take notes on the specific points of the different views aired.

A writer of case studies should realize their following characteristics:

1) Cases are a bit of history; therefore, they must be as accurate and unbiased as they can possibly be.
2) They are a picture of a situation and, therefore, a rich source of material from which students can derive insight and opinions.
3) Case studies indicate relationships, both formal and informal. This is as opposed to organizational diagrams which only show formal relationships.

4) Cases depict motion. They show facts in motion and facts in the making.

5) Background material is important, but it should not be of such magnitude as to overshadow the central aspects of the case. It should be used to help give setting and context so as to enable the student to come to grips with the problem posed.

Finally, what is specifically needed to implement the case study approach in Florida public schools is a case book containing a selection of environmental case studies written for the secondary level student. This book would contain approximately ten studies of situations that have occurred at the local level of government and that could occur in almost any typical city in Florida. They could then be used with the idea that the teacher would consider the use of the studies that pertain to an environmental matter currently active in his locality. This would give the student a chance to attend one of the public meetings and, thus, carry their environmental education to that final step of involvement.

The following is a list of possible environmental case study areas that this book might include:

1) Land use (planning, zoning, flood plains)

2) Population control (density, caps, managed growth policies)

3) Water quality

4) Solid waste recycling plants

5) Dredge and fill

6) Bicycle paths

7) Beach access (perscriptive easement)

8) Banning one-way containers

9) Air quality

10) Establishment of Environmental Advisory Boards

11) Noise and tree ordinances

12) Road right-of-way expansion

13) Parks and historical sites

14) Movement of surfing beaches

15) Wildlife area preservation

2. The student must realize that the political process around policy making exists at many levels. These processes include, not only, the play outline, but also, the citizens, the voter and parties, interest groups, organized formal cooperation of policy makers, and the informal relationships as well.

3. To bring this newly aquired information together, the student will: 1) view these processes in action within the classroom through an environmental case study and then; 2) view this same process in real life through actual attendance of a local public hearing pretaining to a similar matter studied through the case study.

V. EVALUATION:

Pretaining to the case study alone there are no real, specific answers. Therefor the student should be evaluated on the basis of his argument and how he coordinates and logically handles the facts and raw data.

I. UNIT TITLE: Policy Making and Political Behavior

II. STATEMENT:

The concept of the policy making process will be utilized to achieve a focus of inquiry into certain aspects of political processes. The concept does not make strict use of the traditional "sequence of steps" approach, such as: I) appraisal of possible policies; 2) inquiry; 3) identification of goals; 4) canvass of possible policies to achieve goals; and 5) choise and decision. This methcd wrongfully implies that policies are the product of one governing mind. It fails to evoke or suggest the distinct political aspects of policy making.

III. OBJECTIVES:

A. To develop a realistic feeling for the policy making process.

B. To become aware of the existance of politics and the informal relationships in policy making.

C. To identify political behavioral analysis methods and to realize their limitations.

D. To identify access points within the policy making process.

E. To develop a sense of what a citizen must be, have, and do to influence policy.

F. To aggregate these objectives and to use this knowledge to show the reasons why environmental insults continue to exsist and why some are even promoted through our policy making process.

IV. LEARNING STRATEGY:

I. Before one studies a particular subject he should be familiar with the methods of analysis that are peculiar to that discipline, its limits, and how to work within those limits to produce correct information.

TEACHING - LEARNING UNITS

FOR

ENVIRONMENTAL STUDIES

Level 2 - Elementary

Level 4 - Secondary

Bryan C. Smith
Wynn F. Updyke
University of Florida

Health Education
Unit: Environment
Elementary - Level 2

Introduction

Valuing is a process in which the student is confronted with a situation, analyzes it, and then makes a decision in connection with it. For the process to be able to work, the classroom has to have an atmosphere of understanding and acceptance. The values that the teacher has developed should serve only as a guide to the student and not be imposed on the student. There is no single system of values that can be prescribed as absolutely "right" for everyone.

Objectives

1. To develop an awareness of environmental problems.
2. To become aware of the variety of values people have toward the environment.
3. To develop a knowledge of the consequences when nature is abused.
4. To understand that there is a limited supply of natural resources.

Learning Strategies

A. Facts Level

Reading; Archer, S. G. Rain, Rivers, and Reservoirs: The Challenge of Running Water. Coward.

NTRDA. Air Pollution: The Facts. National Tuberculosis and Respiratory Disease Association.

Discussion; 2 - 50 minute periods

B. Concepts Level

Rank Order; 2 - 50 minute periods

C. Values Level

Valuing; 2 - 50 minute periods

A. Facts Level

1. What are some things an individual can do to safeguard the water and food he consumes?

2. What are some things a community can do to safeguard water and food supplies before they enter a home?

3. What is meant by pollution? water pollution? air pollution? noise pollution?

4. Is littering pollution? Have you every heard of visual pollution? What is it?

5. Where does your community get its water supply? How is it made safe for drinking? How is milk made safe for drinking? Why the different methods?

6. Where does water come from? If it is destroyed is it ever replaced?

7. Why is air pollution a community problem?

8. What causes air pollution? If it is destroyed is it ever replaced?

9. How do we know when air is polluted? Is it worse today than it was 30 years ago? Why?

B. Concepts Level

Read the following story and then ask each student to rank order the names of the characters from 1 to 5 according to whom they most admire (1)

to the least appreciated (5). After the list is complete ask why they ranked them as they did and discuss the situation.

Brand X Chemical Company was dumping toxic (poisonous) chemicals into the Clara River. The water downstream from the Company become smelly and discolored. Dead plants and fish were found on the river banks. Mr. Williams, president of the company, knew that fishing, swimming, and other river activities were hurt by the pollution but pollution control would cost a lot of money. The company employs about half of Middleburg's residents and pollution control would mean a cut back on jobs. Everyone would suffer -- gas stations, restaurants, theaters, etc. Bills and even taxes would not be paid and more people would go on welfare. Mr. Sams of the Chamber of Commerce didn't want the pollution reported because of the current high unemployment rate in the area. He was working hard to get more tourists to come to Middleburg so that more jobs would be available. One project was an antique train trip that took people to an old ghost town that used to be a mining camp. Mr. Holt, who ran a scenic river cruise up the Clara, feared the competition of another tourist attraction and reported the pollution produced by the chemical company. The company was closed down by a court order and all the employees were out of work. Mr. Diller, mayor of Middleburg went to the state capitol to force the environmental control agency to reverse its decision even though it would still be polluting the stream. Mrs. Talbot, owner of a motel-recreation complex, was so irritated with the mayor's actions that she withdrew support for a community center that was going to be named in honor of the mayor. The removal of these funds meant that the center would not be completed.

Rank Order - -

Mr. Williams (Company President)
Mr. Sams (Chamber of Commerce)
Mr. Holt (River Cruise)
Mr. Diller (Mayor)
Mrs. Talbot (Financial Support for Community Center)

C. Values Level

Read the following statement to the class.

If people must choose between having money with pollution and having nothing without pollution, they would take the money. If an old machine can be replaced by one that goes faster and the owner makes more money by it, he will discard the old machine. Greater profits mean a higher standard of living and that's what everybody wants.

Ask the class -

1. What do you value more than money?

2. Do you agree that everybody wants more money and all it can bring?

3. What is meant by a higher standard of living? How high is yours going to be?

4. What material things do you own now that you'd be willing to give up? Which would you keep?

5. Identify all the electrical appliances in your home? How do they contribute to air pollution? Which would you be willing to do without?

6. If you could change one thing in your community's environment, what would that thing be? How would you go about it?

Evaluation

The absence of tests or grades will allow freer discussion. If necessary, a terminal examination can be given on the facts and concepts level. Do

not test the values level since universal right or wrong values do not exist.

Were the objectives of the unit met?

Health Education
Unit: Environment
Secondary - Level 4

Introduction

This unit deals with local pollution, a community health problem. The strategies recommended, complement the unit since they are community action oriented problem solving techniques.

When the data for this unit are completed, combine them with earlier surveys on food, housing, community services, medical facilities, transportation, and welfare to produce a general community picture. This composite will help the group to determine where the local environment is most deficient and what projects in the community require the most immediate action. The unit's suggestions for study, like its suggestions for action, are only a beginning. The rest is up to the students involved.

Objectives

1. To develop a sense of community.
2. To identify and feel responsible for generating community solutions to meet community problems.
3. To become aware of the complex forces working against a clean environment.
4. To discover how people value the environment.
5. To act on environmental concerns.

Learning Strategies

A. Facts Level

a. Reading; Roueché, Berton. Eleven Blue Men, Chapters 1, 6, and

12. Berkley, Medallion, 1965.

b. Problem Solving; 4 - 50 minute periods

B. Concepts Level

a. Brainstorming; 2 - 50 minute periods

C. Values Level

a. Valuing; 2 - 50 minute periods

A. Facts Level

a. Problem Solving - What is your environment?

The class can be divided into 3 work groups. Each group will work independently but come together to share the data collected after three days.

Regional pollution control agencies and local health departments will provide information. When possible, obtain pollution figures on a local as well as a regional basis so that communities can be compared.

Work group I - Air Pollution

1. What is air pollution?
2. How is it measured?
3. What is the density of each of the following pollutants in your community?

	ppm	tons emitted/day
a. CO		
b. Oxides of Nitrogen		
c. Organics		
d. Sulphur Oxides		
e. Particulate Matter		

4. What is the name and jurisdiction of the regional air pollution control agency?

5. Who selects the director?

6. Does the agency have the power to limit emissions of pollutants

   from industries?
   from automobiles?
   from residences?
   from governmental agencies?

7. In one year how many violations were noted by the agency?

8. How many were prosecuted in court?

9. How many ended in convictions?

10. How much did the total fines amount to?

11. What is the annual budget of the agency?

Work group II - Water Pollution

1. What is water pollution?

2. How is water pollution measured?

3. How many tons of pollutants are discharged into a local river, lake, and/or ocean each day?

4. Who dumps these wastes?

5. What is the name and jurisdiction of the regional water pollution control agency?

6. Who selects the director?

7. Does the agency have the power to limit emissions of pollutants

   from industry?
   from agriculture?
   from private residences?
   from governmental agencies?

8. In a year, how many violations of pollution standards were noted by the water pollution agencies?

9. How many violations were presented in the courts?

10. How many prosecutions ended in convictions?

11. What is the annual budget of the agency?

Work group III - Other Forms of Pollution

Thermal Pollution:

1. What is thermal pollution?
2. What harm is done by thermal pollution?
3. What agency maintains thermal pollution surveillance?
4. What are the sources of thermal pollution in your community?

Noise Pollution:

5. How is noise pollution measured?
6. Describe the following -
   a. the average daily industrial noise level on the street
   b. the average daily industrial noise level inside manufacturing and commercial structures
   c. the average daily transportation noise level for air traffic, train passage, truck and automobile

Visual Pollution:

Choose a typical four block area in the neighborhood of the school and answer the following questions:

What is the number of -

7. Advertising signs (including billboards and real estate signs)?
8. Streets with utility and telephone wires above ground?
9. Vacant or gutted buildings?
10. Abandoned cars?
11. Vacant lots?

12. Uncollected garbage or trash piles?

B. Concepts Level

Brainstorming is a well known widely used problem solving tool. It encourages students to be creative thereby eliciting numerous solutions to any problem.

Rules for brainstorming:

1. Be open. No evaluation of ideas can take place since people tend to become more concerned with defending their ideas than thinking up new and better ones.

2. Quantity is encouraged. A great number of ideas created by a wide range imagination.

3. Encourage people to build or modify the ideas of others. This may lend to new ideas.

After the facts level is completed a number of problems will emerge. Brainstorming sessions should be conducted to help identify some alternatives.

Possible problems might include:

1. What ways can be used to get the city council concerned about ...
2. How can we get Industry to reduce the pollution level?
3. How would life be different if we didn't ---
4. Which is the most damaging form of pollution we found?
5. How can it be reduced?

After the alternatives are identified an evaluation of the consequences is necessary so that a good choice is made. Each student is asked to identify which three alternatives they feel are the most feasible solutions. For each of these alternatives they are asked to list as many consequences

as they can think of. As a group they may rank order the alternatives by discussing the merits and shortcomings of each.

C. Values Level

Students are asked to write their responses to the following sentence stubs. After completing these, they get into small groups and exchange ways in which they were completed.

1. I would rather have a little pollution than ...
2. Pollution laws are ...
3. Agencies which are concerned about pollution ought to ...
4. If one environmental problem could be corrected, I'd choose ...
5. Most people feel that pollution ...
6. My biggest contribution to pollution is my ...

List the following groups of words on the chalkboard and ask the class to rank order them. Rank ordering will lead to discussions of why different students have varying preferences.

1. If your community was able to recycle only one type of material, which would it be:

    a. aluminum
    b. glass
    c. paper

2. If your community had one million dollars to serve one environmental need, which would it be:

    a. reduce air pollution
    b. reduce noise pollution
    c. reduce water pollution

3. or

    a. create green belts
    b. recycle "waste" products
    c. buy land for parks

4. or

a. environmental needs
b. medical care
c. education

Evaluation

If it is necessary to evaluate performance to determine what grade has been earned, it is suggested that this be done for the facts and concepts level, but not the valuing. Since there is a desirable answer, but not necessarily a right or wrong answer, the teacher should guard against expressing his own opinion prior to the students' expression.

The absence of tests or grades usually gives way to freer discussion. Students will accept subjective assessments if they are planned and communicated in advance.

Were the objectives of the unit met?

THE LANGUAGE OF ADVERTISING AND THE ENVIRONMENT

(A partial unit of study
for secondary students)

Herb Karl
Communication Education
University of South Florida
Tampa, Florida

FOR THE TEACHER AND THE STUDENTS

This unit is about the language of advertising and the way it affects the environment--the physical environment, both natural and man-made.

The language of advertising has proven itself to be a very powerful form of persuasion (there's even been a book written which states that advertising was largely responsible for the election of a recent President). It makes sense that those affected by its messages try to understand how advertising works. And we're all affected by the language of advertising, directly or indirectly. We all need to know how it works.

The language of advertising is the language of selling. It's the language used mainly by big and little business to sell us (kids and grownups) products (like toothpaste), services (like a roundtrip airline ticket to Europe), ideas (like why we should give a hoot and pollute), and people (like why Senator Whatsizname should be President). The language of advertising is good and bad. It's good, for example, when it's about products, services, ideas, and people that are really good for us, or at least won't harm us. It's bad when it's about products, services, ideas, and people that are harmful to us, either now or in the future.

The affect of the language of advertising on the environment is similarly good or bad. If the environment is being damaged--subtly or openly--through the language of advertising, then we should know about

it. We should be able to look at an advertisement and say: "If we believe what that advertisement says, we might hurt ourselves and the environment." Such judgments are difficult to make, but they're important. And they must be made by each of us when the circumstances demand it, if we are to protect and preserve the environment for ourselves and future generations.

Moreover, we should make ourselves familiar enough with the way advertising works so that we can use its persuasive power to help maintain and improve the quality of the environment. There is nothing inherently evil in the language of advertising. It provides us with the power to sell good or bad products, good or bad services, good or bad ideas, good or bad people.

The objectives of this unit are as follows:

1. Given any advertisement (magazine, newspaper, billboard, TV commercial), students will be able to identify what claims and what appeals are being made.

2. Students will, by rational argument or through empirical means, judge some advertisements to be directly or indirectly damaging to the environment.

3. Students will create an original advertisement or series of advertisements which (a) are designed to expose advertising that is damaging or potentially damaging to the environment or (b) focus attention on some environmental problem or potential problem that demands public attention and action.

The unit format consists of a series of "problems" and "discussions." The problems are initiated by the students while the discussions are initiated by the teacher. There is no specified time period during which the students must complete the unit and, of course, the "problems" which follow represent only a sample of what could happen in the unit.

PROBLEMS AND DISCUSSION

PROBLEM 1

From an old magainze or newspaper, clip an advertisement. Bring the advertisement to class. Make a list of statements in the ad that tell something about the product, service, idea, or person; however, make sure that the statements can be proven true or false. (Example: An ad for a watch states that it is "waterproof." This statement can be checked--perhaps by placing the watch in a cup of water overnight. If the watch still works after the test, we can say that the ad contains a true statement, at least insofar as the particular test confirms it to be true.)

DISCUSSION

If you were able to find statements which could be proven true or false in the ad you clipped, you actually found what is known in the language of advertising as CLAIMS. CLAIMS are statements found in ads which can be verified (proven true or false). Ads, therefore, can contain TRUE CLAIMS or FALSE CLAIMS. Incidentally, you don't usually find too many CLAIMS in ads anymore. In fact, many of you probably found no CLAIMS in the ad you clipped. Why do you think CLAIMS seem to be going out of style in advertising?

PROBLEM 2

Clip an ad which contains no CLAIMS. (The one you used in PROBLEM 1 can be used if it contains no CLAIMS.) Since the ad does not

resort to making a CLAIM about the product, service, idea, or person, how does it make its selling message?

DISCUSSION

The language of advertising is as much about APPEALS as it is CLAIMS. Nowadays it's probably more about APPEALS. When an ad makes no CLAIMS, it's making an APPEAL. APPEALS have more to do with the buyer than what is being sold. Therefore, the ad you clipped is probably trying to create an APPEAL--that is, the ad is trying to APPEAL to a particular vision which the potential buyer has of herself or himself. (Example: If the ad seems to imply through words and/or pictures that men who are rugged, tough, and masculine use a particular product, then the ad will APPEAL to those men who like to think of themselves as being rugged, tough, and masculine. What's the APPEAL in the ad you clipped?

PROBLEM 3

Paul Swatek, in a book called The User's Guide to the Protection of the Environment (Ballantine Books: 1970), is concerned about the advertising of products and services which are potentially damaging to the environment. He presents a list of products that are made to appear like necessities:

> Do you need these? Explore the following list and decide which of the items on it are essential and which are merely "convenient."
>
> --Electric comb
> --Electric knife or carver
> --Electric charcoal starter
> --Electric can opener
> --Electric broiler (besides the broiler in your oven)
> --Electric hedge trimmers
> --Power lawnmower
> --Electric shaver
> --Higher intensity lighting

--Home garbage compactor
--Home incinerator
--Total air conditioning
--Food waste disposal unit

DISCUSSION

A poll can be taken in order to find out which of the items students find "controversial." Some may feel that many of the items on Swatek's list are necessities or, at least, are not a threat to the environment. If this is the case, interested students could be asked to debate the pros and cons of those items.

PROBLEM 4

Find an ad (printed, radio, or TV) which you feel might be harmful--directly or indirectly--to the environment. Prepare a brief statement--accompanying a copy or transcription of the ad--which indicates your specific objections to that which is being advertised.

PROBLEM 5

Write a letter to the company which advertises the product, etc., explaining why you think it is potentially harmful to the environment. Read the company's reply to the class when you receive it.

PROBLEM 6

Create a counter-advertisement--one which reveals why you feel the product is potentially harmful. The ad may take the form of a printed ad, a radio or TV commercial, or a billboard ad.

DISCUSSION

Counter-advertising is one of the ways in which advertising can be challenged. STERN CONCERN, a group of people which was very

interested in protecting the public from the kind of advertising CLAIMS and APPEALS students have been studying so far, has created a number of sample counter-ads worth imitating.

PROBLEM 7

Form your own version of a consumer activist group with interested classmates. The steps you might take are as follows:

1. Search for ads (print, radio, TV, billboard) which your group judges to be potentially damaging to the environment.

2. Prepare a report in which you carefully document CLAIMS made in the ad which might be regarded as potentially dangerous to the environment. If the ad rests exclusively on an APPEAL, develop an argument which reveals its potential environmental consequences.

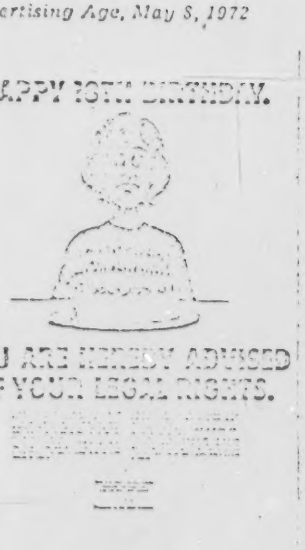
3. Create a counter-ad--one which reveals the environmental hazards of the product, service, idea, or person. The ad can be printed and illustrated, or the ad can be tape-recorded for radio, or the ad can be scripted for TV.

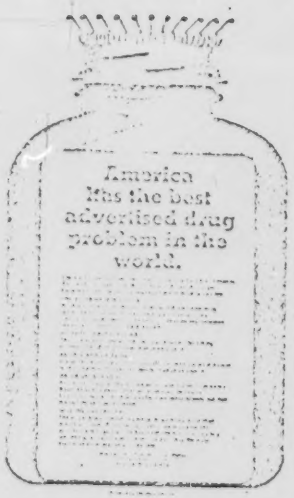
4. Submit the report and the counter-ad to the company which makes the product, performs the service, or is promoting the idea or person. A letter should be attached, explaining that your group is concerned about the environmental consequences of the product, service, idea, or person in question. Wait for a response.

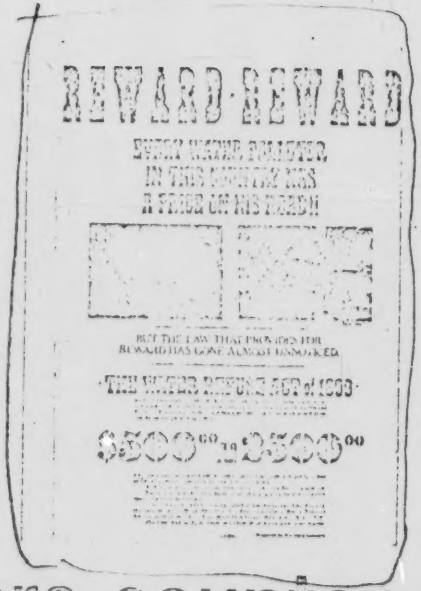
5. Depending on the kind of response you get, consult your teacher about what additional steps, if any, your group might take.

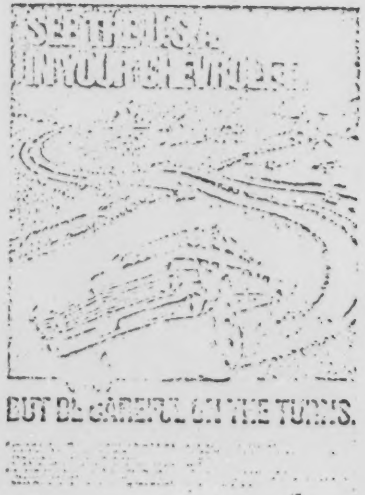
DISCUSSION

Now that students have familiarized themselves with the persuasive power of the language of advertising, they can move from analyzing what they judge to be "bad" advertising to the "good" use of advertising as a means of environmentally educating classmates and the community at large. Encourage students to divide into groups in order to develop a series of "survival" campaigns. Each group or "agency" could









Stern Concern offers counter ads to print media

See editorials on Page 24.

LOS ANGELES, May 3—The Stern Concern, a creative center which produces informational materials for activist consumer groups, is asking print media to run the five counter ads reproduced above.

Each ad is being sent to major newspapers, magazines and college publications under the sponsorship of an authoritative public interest group, such as the Medical Committee for Human Rights in the case of the analgesic ads. Earlier, the three major television networks rejected a tv version of the Chevrolet counter ad (AA, May 1).

In the five ads now being distributed, copy reads:

• "Happy 18th birthday. You are hereby advised of your legal rights.

"You have the right to seek counsel before registering with your local draft board.

"You have the right not to complete any forms or answer any communication from your draft board until you obtain expert advice, as long as you meet deadlines.

"You have the right to obtain a copy of the draft board's medical regulations, and to consult with a physician to determine possible disqualifications.

"You have the right not to cause undue emotional or financial hardship to your family through induction.

"You have the right to object on moral, ethical, or religious grounds.

"And if you'd like to know more, call or write your local American Civil Liberties Union. Remember, you've got rights when you're drafted like you've got rights when you're arrested."

• "America has the best advertised drug problem in the world.

"The more popular headache remedies include Excedrin, Empirin, Anacin, Cope, Vanquish, Bufferin and Bayer. But if you knew the truth, those pills might get pretty hard to swallow.

"The combination drugs. According to a recent American Medical Assn. drug report, combinations of analgesics (pain relievers) are 'irrational' and 'not recommended.' That means remedies like Excedrin, Empirin and Vanquish.

"Buffered preparations. That same report could find 'no sound basis' for taking remedies like Bufferin instead of plain aspirin.

"Aspirin and caffeine. It also found simple aspirin, plus caffeine, which is what Anacin is, does no more for your headache than plain aspirin.

"Bayer vs. Brand X. As for plain aspirin, there is no persuasive scientific evidence Bayer aspirin is more effective at relieving headache than any other brand. It may differ from other brands, but that doesn't mean it works better.

"Save on headaches. The major brand remedies cost up to six times more than ordinary aspirin. Partly because you have to pay for the advertising that gets you

(Continued on Page 134)

Stern Concern offers five ads

(Continued from Page 3)

to buy them. So next time you buy something for your head, use your head. Buy the least expensive plain aspirin you can find."

• "Reward, Reward. Every water polluter in this country has a price on his head!!

"But the law that provides for reward has gone almost unnoticed.

"The Water Refuse Act of 1899 made it unlawful 'to throw, discharge or deposit any refuse matter of any kind or description whatever into any navigable water of the U.S.'. The only exception is when a permit to pollute is obtained from the Army Corps of Engineers.

"The law makes every individual and corporate polluter subject to a fine of $600 to $2,500 for each day of the violation.

"And whoever catches the polluter can get half the fine as a reward.

"There are over 40,000 industrial polluting plants in this country operating outside the law.

"If you want to know how to catch them, write for the Bounty Hunters' Guide on Water Pollution, Project on Clean Water, Natural Resources Defense Council, 36 W. 44th St., New York 10036.

"The best way to fight water pollution is to make your own waves."

■ "According to Bayer's little blue book, the makers of Bayer don't make any sense.

"Lately, Bayer aspirin's advertising has featured a blue book that contains some of the findings of a recent American Medical Assn. drug evaluation.

"Bayer's blue book reports there is 'no sound basis' for taking combination pain relievers or buffered preparations instead of plain aspirin.

"The obvious implication here is that remedies like Cope (a combination of aspirin, caffeine, a buffer and an antihistamine) and Vanquish (a combination of pain relievers) don't make sense.

"Why then, you might ask, do the makers of Bayer also make Cope and Vanquish?

"If you'd like to know, write the president of Sterling Drug. You'll find his address in your medicine chest."

• "See the U.S.A. in your Chevrolet . . . but be careful on the turns.

"If you drive a 1965 to '69 full-size Chevrolet or Nova V-8, or a '67 to '69 Camaro V-8, you're in serious danger.

"Those cars were built with faulty engine mounts.

"If one breaks and the engine shifts, it can jam your accelerator wide open and knock out your power brakes at the same time.

"The greatest dangers are fast starts and turns.

"Several thousand accidents and injuries have been reported, and some deaths have been alleged.

"General Motors has announced they won't give you new engine mounts. But they have agreed to install a free safety cable that'll hold the engine in place.

"That way if a mount goes, you won't.

"If you're driving one of these cars, get it to a Chevrolet service department . . . slowly." #

select an original task or one from the "Activist's Checklist" below (in Ecotactics: The Sierra Club Handbook for Environment Activists, Pocket Books: 1970). The "agencies" then prepare a complete advertising campaign (print ads, TV and radio spots, etc.). Ideally, the ads could be run in school and local newspapers, posters could be tacked up in school and around the community, local radio and TV shows could run some of the spot commercials. If change is to occur, the public must become aware of the concerns of young people.

The Activist's Checklist

Don't buy beverages in one-way ("no deposit, no return") containers; save the two-way bottles and return them to the store. Use as little tinfoil and plastic wrap as possible. They are non-biodegradable. Save six-packs of empty one-way containers and ship them back to the board of directors of the company that manufactured the product. Tell them that you are tired of "no deposit-no return."

Save water. Put bricks in the tank of your toilet so it uses less water when flushed. Don't leave the faucet on while you're brushing your teeth.

Avoid using electrical appliances, especially dishwashers, in the evening "prime" hours (5 to 7 p.m.). This is "peaking power" time, and your participation in it justifies many Bureau of Reclamation and municipal utility claims that more dams or other power facilities are needed. Do you really need an electric toothbrush? An electric can opener? An electric carving knife? Whatever happened to muscle-power?

Consume less. If we begin by reducing our personal overconsumption, we may, one day, begin to live in harmony with the land.

Find a dirty hillside, creek, canyon, beach, or roadside. (You won't have to look far.) Tell the landowner you're going to clean it up. Call the (underground/above ground) newspapers, TV, radio, and tell them what you're doing. Call the city refuse collection department. Ask how to recycle the various types of waste you expect to collect. If it can't be recycled, why not? If it can, separate the garbage into piles of paper, glass, aluminum or tin cans, plastic, scrap iron, etc. Are any of the containers returnable? Why not? Where does the refuse collection department take the solid waste materials it picks up? Where does this waste wind up? In the air above an incinerator, or buried in a marsh?

Look at your community's lakes, ponds and watercourses. How polluted are they? Can you drink from them? Can fish live in them? Can you swim in them, or use them for recreation of any kind? Ask the local office of the Federal Water Pollution Control Administration (Department of the Interior) about its standards for water quality. What is it doing--specifically--to control pollution? Is it enough? What pollutes the water locally--factories, sewage treatment plants, agricultural run-off? Locate your sewage disposal plant and ask for evidence of its efficiency. How much untreated water each week goes back into the water supply? What happens to the sanitary sewers when it rains? Write your state department of health or water quality board and request sterile sample bottles and directions for testing the quality of ponds and streams. No bottles, no directions? Why not?

Consider the air. Does it smell bad? Does it fog the view? Ask the local air pollution control agency what its standards are for air quality. How well is it able to enforce them? Does the state have stronger or weaker standards, or none at all? Report observable violators (smokestacks, transit systems, etc.). Be specific.

Do you have a favorite haunt or campsite in a national park, on a wild riverbank, on an ocean or lake beach, high mountain pass, grassy meadow? Are there plans for its "improvement"? Find out from the tax office of the county in which it is located who is responsible for its administration--private owner, National Park Service, U. S. Forest Service, Bureau of Land Management, state or federal fish and game agency. If development plans exist, what are the administering agency's standards? Do they provide adequate safeguards? What do <u>you</u> think should be done in the area, if anything?

Does your town, country or region have an inventory of open space lands? Why not? Is there a vacant lot in your neighborhood that could be made into a park or recreation area? Find out from the county tax assessor's office what the plans are for its disposition. How many downtown outdoor parking lots are scheduled to have high-rise office or apartment buildings constructed on them? What will this construction do to the city's density, services, "tax base"? Does your county council or board of supervisors know why open space in the inner city is so essential? Maybe not. Educate them.

WHERE HAVE ALL THE DODOS GONE?

(A partial unit of study on extinct and endangered species for intermediate elementary students)

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FOR THE TEACHER

One of the fundamental laws of the environment goes something like this: When the environment in which an animal lives changes, then the animal too must change or it must move away from the environment; for if it does not change or move away, it will surely die. If there is one large underlying purpose of this unit, it is that the students understand this law and its possible consequences.

Hopefully, students will discover this law for themselves as they encounter the various problems which comprise the day-to-day activities of the unit. The focus is, of course, on those animals which--for one reason or another--were (or are) not able to change or move as the environment changed/changes. These animals are either extinct or they are endangered.

While man is the most adaptive of all animals (he is most capable of changing in accordance with the changes in his environment), there are limits to everything. When change is too fast (when the smog gets too thick, when the mercury levels in fish rise too quickly, when the dosages of DDT are too heavy), even man cannot change fast enough. He too can fall into the "endangered species" category.

The objectives of this unit are as follows:

1. Students will select an endangered or extinct animal and find out as much as they can about it. This information will be transformed into a "book."

2. Students will participate in the creation and production of a drama about an extinct or endangered species.

PROBLEMS AND DISCUSSION

PROBLEM 1

After viewing several films (e.g., "American Bald Eagle") and looking through a number of books and magazines, select an extinct or endangered animal to study on your own. Try to find as much information on the animal as you can: go to the libraries (school and public), interview your parents and others who might be able to help. Put all this information into a box or folder (copy or summarize the information if necessary).

DISCUSSION

There are a number of extinct and endangered animals, among them:

1. the bald eagle
2. the wolf
3. the tiger
4. the dodo bird
5. the pelican
6. the buffalo
7. the loggerhead sea turtle
8. the sea cow or manatee
9. the coyote

You may want to direct students to these and other animals which appear in resource materials which you have collected especially for this unit.

PROBLEM 2

Prepare a report on the animal you have chosen to study. Try to answer the following questions:

1. Is your animal extinct or endangered?
2. What were the causes of the animal becoming extinct or endangered?
3. Why wasn't the animal able to change or move in order to survive?
4. Do you think the extinction of this animal is/was inevitable?
5. What would have helped the animal to survive?

PROBLEM 3

Prepare a book on the animal which contains your written report, illustrations clipped from magazines, creative pieces (original drawings, poetry, etc.).

DISCUSSION

Children should be encouraged to exchange their books at the conclusion of the book-making activity. Perhaps, they can be displayed somewhere in school.

As an alternative to having children develop their own books, have them gather information individually and pool their work in the creation of a class-made book--a group project for which the teacher can write an "introduction."

PROBLEM 4

With your classmates, write and enact a play about extinct and endangered species. The play should feature the various animals which have been studied earlier by you and the rest of your classmates.

DISCUSSION

The teacher will want to guide this creative group project. Ideally, the play would transmit the causes of the demise of each animal. In a series of soliloquies, each animal could tell why it is either extinct or endangered. Also, this would be an excellent opportunity for the children to create their impressions (through pantomime) of the principal behavior patterns of each creature.

SAMPLE: An Experience Guide for K-12 Teachers
in Arts Education and the Environment

BY:

George Pappas

An Experience Guide for K-12 Teachers in Arts Education and the Environment

The following material gives an indication of the kinds of experiences which might be developed by classroom teachers. The proposed sample curriculum suggestion is developed around the first of four central areas of environmental concern.

1. Perceptual sensitivity and the structure of the natural environment
2. Technological awareness
3. Survival of other species
4. Natural resources

Since it is the function of the teacher to adapt available information to relate to his particular grade level and situation no attempt has been made to separate elementary from secondary experiences. All of the ideas suggested in this sample curriculum can easily become learning experiences for both elementary and secondary students.

ENVIRONMENTAL AREA #1

Perceptual Sensitivity and the Structure of the Natural Environment

Every age has made interpretations of nature in its own style. In this process of interpretation the true essence of man has been revealed throughout history. Whether it be through philosophy, science, religion or art, the fact that man in some way relates to his natural environment cannot be denied. Even today's emphasis on technology has provided contemporary man with the ability to seek new horizons in a natural environment that spans a vast scale from the tiniest particles and patterns to the immense space of the universe. In our contemporary look at the natural environment, it is the "structure" of the environment that is of primary concern. Understanding the structure of the environment has become an important consideration in both art and science.

Jacob Brononski concludes an article on The Discovery of Form with the following statement:

> "For fifty years we have been living in an intellectual revolution, in which interest has shifted from the surface appearance to the underlying structure, and then from the gross structure to the fine organization of minute parts in which only the total pattern expresses an order. And while critics have argued who has the monopoly of the new vision, and which culture ought to scorn the other, artists and scientists have gone quietly about

their business of feeling and expressing

the same common revolution."

EXPERIENCE UNIT #1

FORM IN THE NATURAL ENVIRONMENT

1. UNDERSTANDING FORM THROUGH OBSERVATION AND DRAWING

Collect natural forms from the environment. Select objects that are small enough to fit in the hand such as shells, pebbles, leaves, seed pods, toadstools, pine cones, etc. Study each object, comparing its size, shape, taste, color and structure. In an attempt to understand and observe the object in more detail make several contour drawings of the object. Concentrate on the details of its contour only.

Younger children could classify object according to shape or texture in several boxes or cases. Put all rough objects together, all smooth objects together, all round, etc. Discuss the similarities and differences in the collected objects.

Materials: Use white or colored drawing paper and drawing instruments suitable to detailed work.

2. THE SOURCE OF FORM

Study the environment from which the form in the preceding experience was selected. Discover the peculiar qualities that make the form an integral part of its environment.

For example: A seashell has certain characteristics that relate it specifically to the ocean. The shape, the texture, the color, all have direct relationship to the environment in which it exists. Make plans for a field trip and with a polaroid camera, make photographs of the object and the environment from which it was selected.

In a visual presentation, show and explain this relationship between the objects and the environment so others can understand. Show how the color, texture and shape of the object relates to its environment.

Materials: Polaroid camera, posterboard, paint, typewriter.

3. THE TRANSLATION OF FORM THROUGH PHOTOGRAMS

By using a strong artificial light source and photographic paper, translate the form onto the sensitized surface. By controlling the source and intensity of the light attempt several variations and distortions of the form. Combine several forms and consider their relationship on the paper.

Develop relationships between finished photograms by a number of students and combine them to make a photographic mural. Subject matter for the mural could relate to the object used. For example: All the photograms related to sea life could form one mural -- others could be formed from photograms of trees, seeds, man-made objects, etc.

Materials: Found objects, photo-sensitive paper, chemicals for developing, safety light.

4. THE FORM AS A STRUCTURAL MODULE

Every object studied has a unique structure. Explore carefully the physical structure of each form. How is it constructed? How are the parts attached? How is the total form supported? Isolate the unique structural characteristic of each form and attempt to reproduce it in a model with art materials.

For example: The inner structure of a sand dollar could be reproduced in clay. The way the separate units of a pine cone are organized and attached could be studied and constructed with wood or paper.

Emphasis should be placed on understanding the physical structure of the natural object being explored and the way it usually grows or develops through the regeneration of single modular units.

Materials: Found objects and a variety of scrap materials such as paper, cloth, plastic, plaster, balsa wood, etc.

5. A FILM SEQUENCE OF CHANGE IN NATURAL FORMS

With the use of Super 8 movie cameras and tripods, make a short film showing the changes in the form of natural objects that takes place over a period of time. Set up the camera in a certain location and on a regular timed schedule take a sequence of shots showing the change.

Examples of topics: A spider spinning a web, changing tides, sunsets, stop action of a flower bud opening, the beginning of a storm, etc.

EXPERIENCE UNIT #II

TEXTURE IN THE NATURAL ENVIRONMENT

1. ESTABLISHING A TACTILE RELATIONSHIP WITH NATURE

Experience as many textures in the natural environment as possible. Organize a field trip to a natural sight such as the seashore, woods, fields, caves, etc. With the students working in pairs, have one student blindfolded. The other student acts as his guide and recorder. The students move through the area touching and verbally responding to as many textures as possible. The recorder will keep a journal or tape record each of the responses to the experienced texture. Compare the responses by each student to similar experienced textures. Did everyone respond in the same way?

Materials: Blindfolds, tape recorders or note books.

2. DEVELOPING A TEXTURE WALL

Have students make a collection of many objects having unique and different textures. Develop a texture wall by having the students mount objects on a single board and then combine them to create a textured wall surface. Each single unit should have its own characteristic texture. When the units are combined, differentiate between textures by having the surface alternate from smooth, subtle textures to dominant, rough areas. Hang in a room or hallway where passing students may experience the variety in textures by running their fingers over the surface.

Materials: Found natural objects, poster board, glue.

3. TACTILE DISCRIMINATION

Develop tactile boxes or bags in which natural environmental objects are placed without being seen. Attempt to identify objects through tactile sensitivity alone. Each student attempts to develop his tactile sensitivity until he can identify every natural object collected by the class.

Materials: Cardboard boxes, scissors, paint, tape.

4. TEXTURE RUBBINGS

Textures can be copied from the environment with brush or pencil. Textures can also be created by a rubbing technique used by archeological researchers. Thin, tough paper is placed on the textured surface and then rubbed with wax crayon, lithographic crayon or graphite stick. The texture will be revealed in reverse value.

Materials: Heavy tracing paper, wax crayons, lithographic crayons, graphite stick or chalk.

EXPERIENCE UNIT #III

COLOR IN THE NATURAL ENVIRONMENT

1. COLOR STUDIES OF NATURAL OBJECTS

Color studies could be developed through a systematic analysis of color in the natural environment. Select certain environmental objects or sights that represent a varied range of colors. Make drawings or paintings with crayons, paint or pastels with the emphasis on details of color. Differentiate between external and internal color in an object.

Materials: Drawing paper or canvas, acrylic paints, brushes, crayons, pastels.

2. COLOR AND NATURAL CAMOUFLAGE

Study the relationship of the color of objects to their total environment. How does the color reveal or camouflage the natural object? Construct a white geometric form from poster board. Place it in a natural setting and with art materials attempt to so closely relate it to its environment that it almost disappears.

Materials: White construction board, glue, tape, paint and brushes.

3. COLOR AND LIGHT IN A NATURAL SETTING

Consider the relationship between color and changes in the intensity of light. With a camera, make color slides or photographs of portions of a particular environment during early morning, mid-day, sunset and night. Mount or project the images in a series to show how light affects the color of the object.

Materials: Cameras, film, poster board, glue, slide projector.

EXPERIENCE UNIT #IV

SOUNDS IN THE NATURAL ENVIRONMENT

1. SOUNDS IN THE NATURAL ENVIRONMENT

A) With portable tape recorders make some sound studies of the natural environment. Attempt to find a variety of natural sounds that will describe audio-contrasts. For example: The sound of wind blowing through the trees would be very different from a clap of thunder.

B) Collect a series of sounds from one particular location over a period of time from early morning til night. Become aware of the subtle changes in sound that may occur even in restricted, secluded areas.

2. COMPOSING WITH NATURAL SOUNDS

Collect all the sound tapes that have been made by the class. Discuss the possibility of categorizing the sounds, editing them and composing a sequence of sounds that has structure. Topics for sound compositions could be related to happiness, conflict, love, anger, etc.

3. NATURAL FORMS AS INSTRUMENTS

Explore the possibilities of making sounds from collected natural environmental objects. Try rubbing objects together, dropping them into a pail of water, hitting them with a stick, etc. Organize the sounds each student can produce and arrange a rhythm composition.

EXPERIENCE UNIT #V

UNDERSTANDING THE NATURAL ENVIRONMENT

THROUGH RELATED ART FORMS

1. DANCE INTERPRETATIONS

From the natural environment, identify certain elements that are constrantly in motion. For example: A moving brook, trees in the wind, leaves falling from trees, clouds during a storm, etc. Develop dance movements related to each of the discovered natural elements. Choreograph the movements into a structured dance presentation.

2. COMMUNICATING PROTEST

Isolate a particular problem related to the natural environment in your area. Construct a protest box with your class to be sent to the state legislature. Decorate a cardboard carton and enclose some of the following: posters emphasizing the particular problem, poems, tape recordings of people interviewed about the problem, photographs, a film, individual letters from students, a list of possible solutions, etc.

3. LOCAL NEWSMAGAZINE

Have students prepare a local newsmagazine related to some problems of the natural environment. Use drawings, poems, essays, cross-word puzzles, riddles and cartoons related to environmental problems.

4. DRAMATIC PRESENTATION

Students could write and enact an original play about a severe problem in the environment. The play could have two endings, both presented to the audience, showing how the play would end if the problem is attended to, and how it would end if nothing is done.

DEVELOPING AND USING SCIENTIFIC SKILLS IN THE SCHOOLYARD

By: Lehman Barnes and George Dawson

Introduction

The student must be given a variety of opportunities to scientifically study the environment. The development and active use of fundamental scientific skills is certainly possible in an area easily accessible on a day-to-day basis -- the schoolyard. For the elementary student, very little material is necessary and most can be either constructed or obtained at little or no cost. In fact, part of the activity can be the designing and constructing of the materials needed in the outside experience. The activities can focus on a series of questions or instructions which invite the youngster to become involved in the use of a particular skill, e.g., observing. Students can be encouraged to ask their own questions to make sense out of the environment for themselves. The following pages suggest some examples of activities which emphasize certain skills.

Activity: OBSERVING

Materials: Containers for collecting
Paper
Pencil

GO OUTSIDE and:

(1) name all the colors you see
(2) find the tallest tree and shortest tree
(3) name as many different sounds as you can
(4) find five cool objects and five warm objects
(5) name as many different odors as you can
(6) find five rough objects and five smooth objects
(7) find ten different insects
(8) describe a cloud
(9) describe the biggest object you can find
(10) draw a blade of grass

Activity: INFERRING

Materials: Paper
Pencil

GO OUTSIDE and EXPLAIN:

(1) Why there is more grass in certain parts of the schoolyard than in other parts?

(2) Why there are more weeds in certain parts of the schoolyard than in other parts?

(3) Why the ground is harder in certain parts of the schoolyard than in other parts?

(4) Why there is more litter in certain parts of the schoolyard than in other parts?

(5) Why there are more students in certain parts of the schoolyard than in other parts?

(6) Why there are more insects in certain parts of the schoolyard than in other parts?

(7) Why it is hotter on one side of the building than on another side?

(8) Which animals must be present but why they can't be seen?

(9) What the skid mark on the sidewalk tells you about the speed and direction of the bike?

(10) Why the tree died?

Activity: MEASURING

Materials: A measuring instrument
Paper
Pencil

(Note: students can design their own measuring instruments)

GO OUTSIDE and MEASURE:

(1) a blade of grass
(2) the distance around a tree
(3) an ant
(4) one of your classmate's shoes
(5) the distance between the building and the nearest tree
(6) the distance a friend can jump
(7) size of a brick
(8) three different leaves
(9) the distance you can run in three seconds
(10) the smallest object you can find

Activity: CLASSIFYING

Materials: Boxes
Paper
Pencil

GO OUTSIDE AND FIND TEN OF ANYTHING (E.G., ROCKS). PUT THE OBJECTS IN TWO BOXES SO THAT THOSE OBJECTS IN ONE BOX ARE DIFFERENT IN SOME WAY FROM THOSE OBJECTS IN THE OTHER BOX. TELL HOW THE TWO GROUPS ARE DIFFERENT.

PUT ALL THE OBJECTS PACK IN ONE PILE. NOW SEE IF YOU CAN PUT THE OBJECTS IN THE TWO BOXES IN SOME OTHER WAY AND TELL HOW THEY ARE DIFFERENT.

Some objects:

(1) Rocks
(2) Insects
(3) Leaves
(4) Weeds
(5) Sticks
(6) Spoonfulls of dirt
(7) Blades of grass
(8) Seeds
(9) Mushrooms
(10) Pieces of litter

Activity: PREDICTING

Materials: Paper
Pencil

GO OUTSIDE and PREDICT WHAT WOULD HAPPEN IF:

(1) all the grass in the schoolyard was removed

(2) it rained every day and night for a month

(3) you covered a part of the schoolyard with a thick cloth

(4) no one mowed the grass

(5) you piled some wood in a corner next to the building and left it there

(6) you threw bird seed in the same place every day

(7) you placed a large trash can in the middle of the schoolyard

(8) you planted _____ in a part of the schoolyard

(9) there was no schoolyard

(10) your class could change the schoolyard in any way it wanted to

WHY DO YOU THINK THE THINGS THAT YOU PREDICTED WOULD OCCUR?

A BIOLOGICAL COMMUNITY: Individuals and Populations

This is a series of activities that should give you some idea of what a biological community is and how a person such as an ecologist determines if changes are occurring in that community.

List of materials:

1 - piece of string 4 - 6 meters long

1 - meterstick

1 - notebook

4 - sticks -- 10 - 15 cm long

1 - hammer

20 large nails

Locate a grassy area in the school yard that is at least one meter square. Using the sticks, mark off the corners for a one meter square plot. Run the string around the outside of the sticks to indicate the boundaries of the one meter plot.

In this investigation, you will be counting individuals. That may seem easy enough because you can count 1, 2, 3, 4 insects or people. But what about grass? Look at the grass in your plot. Where does the individual begin and end? An individual is usually defined as the smallest separate part that can reproduce and nourish itself. In other words, an individual is the smallest unit that can live and reproduce. You may feel comfortable with saying that an ant is an individual, but the grass is another problem. Often, in science, the student has to make arbitrary decisions such as you now face because there is not a clear answer. So, just decide what you are going to call an individual grass and not let the definition of an individual bother you too much.

1. How many blades of grass would you estimate are in your plot?

To find out if your estimate is correct, you could of course count each blade. An easier way is to take samples.

Set up a plot ten centimeters square inside of your one meter plot. Use the nails to mark the boundaries of the smaller plot.

2. How many of these smaller plots will fit inside of the larger?

Set up four more 10 centimeter square plots inside the larger one meter square plot. Now, count all the blades of grass in the five plots. Record your counts in Table 1 in the "Total" column. Now, divide the total count by 5 and enter under "Average."

Table 1

Plot	1	2	3	4	5	Total	Average
grass							

3. How would you estimate how many blades of grass there is in the one meter square plot? _____

_____

4. How many blades of grass do you estimate is in the plot? _____

_____

Note: This is a good place to stop if time is running out. Continue from here at your next opportunity.

Ecologists use sampling frequently to estimate the number of whales in the sea, deer in a forest, and the numbers of trees on a mountainside. They do some things differently. For example, an ecologist would select the location of the one meter plot randomly. He would also select many one meter plots, not just one. This means that he would have marked off the entire grassy area of the school grounds in one meter plots, numbered them, and then would have drawn a number from a hat, or cast dice to determine which plot he would study. When selecting the small plots, the same techniques would have been used in selecting the location of the five smaller plots. By doing this, the ecologist assures himself and others that he did not "bias" his sample. By that, he didn't choose an area with little grass so that it would be easier to count. Likewise, if you choose a very grassy area, it may not represent the total grassy area.

You have been looking "nose to nose" at individuals of grass. A group of interacting individuals of the same species within an area at a point in time is called a population. Therefore, the grass in your one meter plot represents a population. Likewise, the people in your town can be called populations because they are of the same species, are in an area (the city limits), and at a point in time (now).

You could count other types of plants in your plot to see how many of each type of plant is present. If your teacher kept the records from year to year, future classes would be able to see if changes were occurring in this grassy area of your school.

Ecologists do this all the time to see if populations are changing and then try to find out the cause of the change. If such a change is of concern, you could study many other types of organisms in your one meter square plot.

Counting animals is often very difficult because they move about. Can you figure out a way to count the ants? If so, record your data in Table 1.

5. Is anything feeding on the grass? _____

_____

6. Do any organisms seem to be hiding in the grass? _____

_____

You likely have mentioned several other plants and animals in your larger plot. When two or more populations interact, such as when an animal feeds on the grass, or the dead animal supplies the grass with food, then we are talking about a community.

Often a community is described by the most common plant such as the grassland community. Other well known communities are the temperate deciduous forest, tropical rain forest, chapparral, spruce-fir and tundra.

Your one meter plot is such a community. Things grow in it. Things die. It is always changing. If you have the time, find out all you can about it.

PROBLEMS ABOUT POLLUTION

A Sample Interdisciplinary Environmental Education Lesson Plan

Written by:

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Laurence R. Wantuck, Nova Schools

Rationale: This lesson is designed to be employed as a part of a unit combining interdisciplinary activities with the theme of environmental pollution. The activities allow for individual differences in interest by applying the appropriate computational skills in problems associated with water pollution, air pollution, and noise pollution.

Objectives:
1. Given a problem solving situation related to pollution, and involving computation with whole numbers, the student applies appropriate problem solving techniques, and arrives at a correct solution.
2. Upon request the student demonstrates an understanding of the causes of pollution by stating a minimum of three factors which contribute to pollution of air, water, or sound in his community.

Materials: A classroom set of printed units, Problems About Pollution.

Procedures: Introduction - The teacher leads a short sharing session in which students comment about examples of pollution they have observed in the community or read about in newspapers. Each case is categorized as air, water, or noise pollution.

Activities - The printed units, Problems About Pollution, are distributed. Students are allowed to select one of the activities, air, water, or noise pollution, to work on. Students work independently or in small groups. The teacher circulates among the students, offering assistance, encouragement, and suggestions.

Assignment: Each student is assigned to write a story problem involving at least three causes of one type of pollution.

INTRODUCTION

This unit is intended for use primarily by students of mathematics and physics at the high school level. A reasonably sound background in both disciplines is assumed.

During the past two decades the operation of automobiles, motorcycles, trucks, aircraft, and industrial power equipment has increased tremendously. The noise levels generated in urban areas and in many residential areas have reached intensities that are detrimental to the mental and physical health of the population. Noise has indeed become a serious problem, and has long since reached the point, in many areas, that it may be considered a form of environmental pollution.

There is an ever growing concern among governmental agencies at all levels, and by private citizens annoyed with the level of noise in their immediate surroundings, as well. To communicate intelligently about noise levels, and in seeking effective solutions to the pollution problem, one must have some understanding of the basic principles of sound measurement.

It is the purpose of this unit to contribute to a better understanding of the techniques employed in measuring sound intensity, and to provide sufficient factual information to permit and encourage effective participation in efforts to reduce noise pollution.

Excessive noise is a leading cause of hearing loss and certainly may be classified as a kind of pollution. It is estimated that of approximately 200 million citizens of the United States, 20 million have measurable hearing losses. Ten million of these people are considered to have severe hearing handicaps.

No one is immune to the long range effects of noise. There are 16 million people exposed to "on -the-job" noise levels which may permanently damage their hearing. As a result, industry pays approximately $2 million per day to compensation claims, loss in worker efficiency, and reduced property values because of excessive noise.

In attempting to determine or describe the physical effects of noise on people, it is necessary to equate sound intensity to some quantitative system of measurement. This was not a simple task since the physical measurement of noise levels involves the following unrelated characteristics of sound: intensity, frequency, and duration. This unit is devoted to the first of these characteristics, which is the most obvious to the human ear, intensity.

INTENSITY

The intensity (loudness) of a sound is measured in units called "decibels". The decibel is a commonly used unit of relative power which is based on an arbitrary specified standard. Devices emitting sound energy, or those which transform sound energy into electrical energy, are commonly rated in decibels above or below some reference. The decibel is a power ratio is a power ratio equal to the tenth root of 10, or about 1.26. A 1 decibel increase represents an acoustic power output increase of 25.9%. It is interesting to note that the smallest change of sound intensity perceivable by the average human ear is approximately 1 decibel, regardless of the original intensity. Long exposure to noises of 90 decibels may be

eventually harmful to hearing, while noises over 140 decibels may cause pain.

The noise produced by an automobile horn is approximately 120 decibels, whereas, the noise produced by conversational speech is about 65 decibels. Certainly an automobile horn is <u>much more</u> than twice as loud as someone talking! Actually, an automobile horn is over 300,000 times as loud as conversational speech. It should be apparent that "twice as loud" does <u>not</u> mean "twice as many decibels" and vice versa.

If you increase the intensity of a sound by one decibel, you are actually making the sound $\sqrt[10]{10}$ times as loud, or approximately 1.26^1 times as loud. The table below illustrates the exponential, or logarithmic, relationship between the intensity of a sound and the corresponding decibel increase.

DECIBEL - INTENSITY EQUIVALENCES

Decibel (db) increase	(db increase renamed as a factor times 10)	increased factor of intensity (times as loud)	increased intensity in exponential notation
1	$.1 \times 10^1$	$\sqrt[10]{10} \approx 1.26$	$10^{.1}$
2	$.2 \times 10^1$	$(\sqrt[10]{10})^2 \approx 1.6$	$10^{.2}$
3	$.3 \times 10^1$	$(\sqrt[10]{10})^3 \approx 2.0$	$10^{.3}$
4	$.4 \times 10^1$	$(\sqrt[10]{10})^4 \approx 2.5$	$10^{.4}$
5	$.5 \times 10^1$	$(\sqrt[10]{10})^5 \approx 3.2$	$10^{.5}$
10	1×10^1	$(\sqrt[10]{10})^{10} = 10$	10^1
20	2×10^1	$(\sqrt[10]{10})^{20} = 100$	10^2
30	3×10^1	$(\sqrt[10]{10})^{30} = 1000$	10^3

In general terms, sound in the physical sense is a vibration of particles in a gas, a liquid, or a solid. Vibrations in air produce a variation in normal atmospheric pressure. This pressure variation reaches our eardrums, and they too are set vibrating - causing the sensation we call sound.

The physical measurement of a given sound is determined by comparing the variation in atmospheric pressure producing the sound to a base, or reference, pressure of 0.0002 microbars. A microbar is approximately one-millionth of the normal atmospheric pressure.

The formula for determining the number of decibels a sound generates is as follows:

$$SPL = 20 \log 10 \frac{P}{P_o} \text{ dB}$$

where, SPL is the sound pressure level of a measured sound in units of decibels,

dB, or decibels, expresses the logarithmic ratio of a measured sound pressure to a base sound pressure,

P is the average pressure of a measured sound,

P_o indicates the weakest pressure a healthy ear, under ideal listening conditions, can detect. (0.0002 microbars)

This formula can be used to establish a decibel scale for noise levels measured in microbars. The following are two examples which use the formula in this way:

1. Given an average sound pressure, P, of 0.0002 microbars, (the weakest pressure an ear can detect) we have:

   $SPL = 20 \log (10 \frac{.0002}{.0002})$ dB

   $SPL = 20 \log 10$ dB

   $SPL = 20 (1)$ dB

   $SPL = 20$ dB

   In practice, the decibel scale is established by arbitrarily assigning 0 decibels to 0.0002 microbars. This requires us to adjust the result of the formula by subtracting 20 dB.

2. Given that the average sound pressure generated by an air hammer is 63 microbars, we have:

$$SPL = 20 \log \left(10 \frac{63}{.0002}\right) \text{ dB}$$

$$SPL = 20 \log \frac{630}{.0002} \text{ dB}$$

$$SPL = 20 \log 3{,}150{,}000 \text{ dB}$$

$$SPL = 20 (6.49831) \text{ dB}$$

$$SPL \approx 130 \text{ dB}$$

The corrected, or adjusted, SPL is (130 - 20) decibels, or 110 decibels.

The same formula can be used in determining the sound pressure in microbars when the adjusted SPL is known. The following example illustrates the correct procedure:

3. Given an adjusted SPL of 70 decibels, we have:
SPL = 90 dB (the adjusted SPL + 20 dB), therefore

$$90 = 20 \log \left(10 \frac{P}{.0002}\right) \text{ dB}$$

$$90 = 20 \log (50{,}000\ P) \text{ dB}$$

$$4.5 = \log (50{,}000\ P) \text{ dB}$$

Now, we know that if $4.5 = \log x$, we can then use antilogs to find $x = 31{,}620$. Therefore

$$50{,}000P = 31{,}620$$

$$P = 0.6324 \text{ microbars.}$$

A number of possible situations may require the combining of several noise levels stated in decibels. We know from previous examples that doubling the noise source doesn't double the corresponding intensity in decibels. For example, the noise generated by two people talking, each at a level of 65 decibels, is <u>not</u> 130 decibels (double the decibels, or the sum of the two). The actual combined decibel level is 68 decibels. This is only slightly more than the level of one person talking.

What does happen is that the energy level (acoustic power) is doubled. This results in an increase of only three decibels in intensity, however. This relationship is illustrated in the table on page 3. Note that in column 3 where the increased intensity factor is 2, the corresponding decibel increase, shown in column 1, is 3 dB. It is important to remember that in combining noise sources you NEVER add or subtract the numbers of decibels. First, the decibels must be converted to relative energy, added or subtracted, and then converted back to decibels.

The formula relating the number of decibels to amounts of energy or power is as follows:

$$N_{dB} = 10 \log (50{,}000\ w)$$

where, N_{dB} is the number of decibels of a noise source having an acoustic power of w watts.

This formula can be used to combine noise levels in several ways. The following are two examples which illustrate the use of this formula in different situations:

1. What would be the combined noise level generated by two people, each talking simultaneously at the 65 decibel level?

   we are given $N_{dB} = 65$, using the formula we have

   $65 = 10 \log (50{,}000\ w)$

   $6.5 = \log (50{,}000\ w)$

   using antilogs ($6.5 = \log x$, therefore $x = 3{,}162{,}000$) find

   $3{,}162{,}000 = 50{,}000\ w$

   $63.024 = w$

   At this point we have converted 65 decibels to the corresponding acoustic power, 63.024 watts. Since we are doubling the relative energy, we can use a factor of 2 along with the relative energy value to find the noise level in decibels.

   $N'_{dB} = 10 \log [50{,}000\ (2)\ w\ ]$

$N'_{dB} = 10 \log [\ 100{,}000\ w]$

$N'_{dB} = 10\ 10g\ [(100{,}000)\ (63.024)]$

$N'_{dB} = 10\ (\log 100{,}000 + \log 63.024)$

$N'_{dB} = 10\ (5 + 1.7995)$

$N'_{dB} = 10\ (6.7995)$

$N'_{dB} = 67.995$ which is approximately 68 decibels.

In general, if we double the source of any noise we only increase the total decibel output by 3 decibels. Using the formula to show this, we have:

$N'_{dB} = 10 \log [50{,}000\ (2)\ w]$

$N'_{dB} = 10 \log [50{,}000w\ (2)]$

$N'_{dB} = 10\ [\log 50{,}000w + \log 2]$

$N'_{dB} = 10 \log 50{,}000w + 10 \log 2$

$N'_{dB} = N_{dB} + 10 \log 2$, since $N_{dB} = 10 \log (50{,}000\ w)$

$N'_{dB} = N_{dB} + 3.0103$

Therefore, the noise level is increased by approximately 3 dB when the power is doubled.

2. What would be the combined noise level of a vacuum cleaner, generating 74 dB, and a food blender generating 80 dB?

Let w_1 and w_2 be the two acoustic powers associated with the 74dB and 80 dB, respectively. Then we have:

$74 = 10 \log (50{,}000\ w_1)$ and $80 = 10 \log (50{,}000\ w_2)$

$7.4 = \log (50{,}000\ w_1)$ and $8 = \log (50{,}000\ w_2)$

$25{,}120{,}000 = 50{,}000\ w_1$ and $100{,}000{,}000 = 50{,}000\ w_2$

$502.4 = w_1$ and $2{,}000 = w_2$

The next step is to combine the two noise levels by adding $w_1 + w_2$ in the formula:

$$N_{dB} = 10 \log [50{,}000 (w_1 + w_2)]$$

$$N_{dB} = 10 \log [50{,}000 (502.4 + 2{,}000)]$$

$$N_{dB} = 10 \log [50{,}000 (2{,}502.4)]$$

$$N_{dB} = 10 \log 125{,}120{,}000$$

$$N_{dB} \approx 10 (8.09726)$$

$$N_{dB} \approx 81$$

ACTIVITIES

1. Extend the data in the table on page 3 to include increases of 40 decibels, and 50 decibels.
2. A jet engine produces a noise of approximately 140 decibels. An automobile horn produces a noise of 120 decibels. Compute the difference in intensity between them using the table.
3. A Rock band produces a noise level of approximately 120 decibels, whereas a pneumatic drill produces a noise level of 95 decibels. Compute the difference in intensity between them using the table.
4. Given a noise source with a sound pressure of 0.2 microbars, use the formula to find the adjusted SPL in decibels.
5. A vacuum produces a sound pressure of 1.0 microbars, what would be its adjusted SPL in decibels?
6. Given that a subway train generates a noise of 110 decibels, find its corresponding sound pressure in microbars.
7. An air hammer produces 130 decibels, what would be its corresponding sound pressure in microbars?
8. Find the approximate increase, to the nearest decibel, that is generated when the source of a given noise is tripled.
9. Find the combined noise output of a 65 dB and a 74 dB noise source.
10. Find the combined noise of a subway train and an air hammer.

NOISE POLLUTION

A Sample Interdisciplinary Environmental Education

Lesson Plan

Written by:

Ernest E. Burgess Jr., Florida Atlantic University

Lawrence G. Insel, Nova High School

Laurence R. Wantuck, Nova Schools

Rationale: This lesson is abstracted from a unit written for use primarily by students of mathematics and physics at the high school level. The purpose is to introduce the first characteristic of sound measurement - intensity.

Objectives:
1. Given the sound pressure of a noise in microbars, the student computes the corresponding sound pressure level to the nearest decibel.
2. Given the sound pressure of a noise in decibels, the student computes thecorresponding sound pressure level in microbars.
3. Given the sound pressure levels of two noise sources, the student computes their combined sound pressure level to the nearest decibel.

Materials:
1. Newspaper clippings or other appropriate references concerning noise intensity.
2. A classroom set of printed units, Noise Pollution.

Procedures: Introduction - The teacher uses newspaperclippings to generate a discussion about noise and the comparison of sources of noise.

Activities - During the discussion period the following points are brought out:
1. to compare noise sources one needs an objective quantification system
2. comparisons of familiar sounds can be made by quantifying noise sources in decibels
   a) whisper - 30 decibels
   b) conversational speech - 65 decibels
   c) Rock music - 120 decibels
3. the formal definition of 1 decibel is given, emphasizing the logarithmic nature of the function.
4. a short review of computation with logs and antilogs, if necessary

The printed units, Noise Pollution, are distributed. Students work independently or in small groups in the unit. The teacher circulates among the students, offering assistance, encouragement, and suggestions.

Assignment: Students are instructed to complete the problems for the next class session.

PROBLEMS ABOUT POLLUTION

A Sample Interdisciplinary Environmental Education Unit

Written by:

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INTRODUCTION

This unit is intended for use primarily with upper intermediate level students who have mastered the skills needed to compute with whole numbers. It involves the paper and pencil phase of a more comprehensive interdisciplinary approach to environmental education. Although no new mathematical skills or concepts are introduced here, there is an opportunity to apply mathematics in an exciting context, and to practice those skills which have been mastered previously.

Suggested Activities To Accompany This Unit

1. Schedule a class nature walk in which the students observe and record examples of pollution in the community. Later in class, as a follow up, the students categorize their observations as air, water, or noise pollution. They might also discuss the causes of pollution, and possible preventative measures.
2. Discuss examples of pollution on or near your school campus. Categorize each case, and discuss possible actions that the class can take, i.e. a clean up committee, a delegation to your school principal or your school PTA, writing a letter to the city council or to a newspaper, etc.
3. Ask students to clip articles from newspapers and magazines that discuss pollution. Categorize and discuss each article, put together a scrapbook.
4. Assign each student to write his own story problem involving a case of pollution. Each problem should involve some data which results in computation with whole numbers. Make a class book of these problems as a project.

Air Pollution

Our earth is surrounded by a mixture of gases that we call air. The word "air" is often used when we are talking about the earth's atmosphere. There are actually many other things mixed with the air in our atmosphere. Some of these other things are harmful chemicals called pollutants. Pure air is a mixture of gases named Nitrogen, Oxygen, Argon, and Carbon Dioxide. There are also tiny amounts of other gases such as Helium, Neon, and Krypton. Almost all of pure air is Nitrogen and Oxygen. Some of the things that are mixed with pure air are water (in the form of vapor), solid particles (called dust), and small amounts of harmful gases. Pure air is very hard to find because of fuel burning engines, factories, mines, and refuse burning.

The most harmful chemicals in our air are Carbon Monoxide, Sulphur Oxides, Nitrogen Oxides, Hydrocarbons, and tiny particles of solids. These chemicals are unhealthful for plants and animals. They make our eyes burn, our noses run, and can harm our lungs. They also damage paint, cloth, rubber, metals, and many other things.

Most of the polluted air is in or near our cities, because this is where most factories and automobiles are found. The air is so bad in some cities that it even looks gray and dirty. People call this condition smog. In some areas of our country the smog gets so bad that people are asked to stay indoors. Children are not allowed to run and play because breathing fast would be harmful to them. Breathing dirty air makes people sick from lung illnesses more often.

Our government and many citizen groups are trying hard to find ways to stop air pollution. We can all help.

Problems About Air Pollution

1. Air pollution costs every person in Florida about $150 each year. In 1970 there were 6,789,443 persons living in Florida. Find the total cost of air pollution for Florida in 1970.

2. Cigarette smoke is a kind of air pollution, too. A pack of cigarettes costs 50 cents. How much would it cost a smoker in one year (365 days) if he smoked two packs of cigarettes every day? How much would it cost in ten years?

3. Jet airplanes take off at Miami International Airport, one every five minutes every hour of the day and night. Each plane puts 88 pounds of pollutants in the air as it takes off. How many pounds of pollutants are put in the air during:
   (a) one hour
   (b) one day
   (c) one week
   (d) one 30 day month
   (e) one 365 day year

4. Erie County in New York has a serious air pollution problem. The number of people who die from lung illnesses doubles every five years. If there were 263 deaths caused by these illnesses in 1960, find:
   (a) how many people died from lung illness in 1965
   (b) how many people died from lung illness in 1970
   (c) how many people are expected to die in 1980 from lung illness if way is found to stop air pollution.

Water Pollution

When people think of Florida, they often think about water sports. Florida has a great many fresh water lakes and rivers besides all of its ocean and gulf beaches. About 1200 billion gallons of water flow in our rivers every day. Much of this is used for drinking, cooking, washing, and other ways in our homes. Much more water is used by farmers to help grow their crops. Large amounts of water are also used by factories in many ways. Very little water is really consumed. Most of it is used for something and then returned to a river, lake, or to the ocean. Sometimes when the water is used it becomes very dirty. This dirty water is called polluted. It looks dark and muddy. Sometimes it has a bad smell. Polluted water can kill plants, fish, and even animals. We can not use polluted water in our homes or for growing crops.

Factories do much of the water polluting when cleaning or cooling their products. Many towns and cities run sewer lines into rivers, streams, and salt water. If the sewage is not cleaned up before it flows, it also pollutes the water. People are often guilty of water pollution. People who throw litter or spill chemicals, like gas or oil, into water are polluting.

It is against the law to pollute either water or air, but some people do it anyway. The only way we can hope to clean up some of the ugly mess is to help out. Every person has to stop polluting. We also have to help in cleaning up the pollution that is already there.

Problems About Water Pollution

1. We really need only about one gallon of water a day for drinking, cooking, and washing. The average American wastes pure water by using about 150 gallons every day. At this rate, how much water is used by a family of four people in
   (a) one day
   (b) one week
   (c) one 30 day month
   (d) one 365 day year

2. Today we use about 355 billion gallons of water a day. By 1980 we will be using 600 billion gallons a day, and 1000 billion gallons a day by the year 2000. How many more gallons of water will be used daily in the year 2000 than are used today?

3. Factories in the United States use about 175 billion gallons of water daily. They consume only 300,000 gallons. How many gallons of water do factories consume in a 365 day year?

4. It takes 1,400 gallons of water to make $1.00 worth of steel. It takes 300 gallons of water to make one pound of synthetic rubber, and 160 gallons of water to make one pound of aluminum. How many gallons of water are needed to make:
   (a) $1,000.00 worth of steel
   (b) 100 pounds of synthetic rubber
   (c) something made from 150 pounds of aluminum and 12 pounds of synthetic rubber?

5. For 1966 the United States Congress voted $450 million for clean water laws. In 1968 Congress voted only $200 million. How much less was voted in 1968 than in 1966?

NOISE POLLUTION

A Sample Interdisciplinary Environmental Education Unit

Written by:
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Laurence Wantuck, Nova Schools

Noise Pollution

Scientists tell us that sound is caused by waves which are made by vibrating objects. These sound waves travel through the air at a speed of about 1,100 feet per second. The sound waves travel to our ear drums and make them vibrate also. The vibrating makes us "hear" the sound.

A noise which is too loud, too high, or lasts too long can be harmful. Too much noise is one cause of hearing loss. It certainly may be called a kind of pollution. About one person in every ten in the United States has some hearing loss. There are 16 million people exposed to "on-the-job" noise levels which are dangerous to their hearing. Noise pollution costs businesses about $2 million per day because of compensation claims, less efficient workers, and lower property values.

The loudness of a sound is measured in units called decibels. Scientists tell us that listening to loud noises for a long time may harm hearing. The safe level of noise is lower than 90 decibels. Noises over 140 decibels may even cause pain.

Problems About Noise Pollution

1. There are about 200 million people in the United States. How many have hearing losses.

2. If you see a flash of lightening just as it happens, and you hear the thunder five seconds later, how many feet are you from the lightening?

3. How many seconds would it take a "sonic" boom created by a plane flying 33,000 feet high to reach the ground?

4. What is the speed of sound waves in miles per hour?

5. How much do businesses have to pay in a 365 day year for making too much noise?

6. A noisy garbage truck can be quieted with built-in sound deadening equipment that costs about $100.
   (a) How much would it cost a city to quiet 20 garbage trucks?
   (b) If there are about 35,000 families in the city, how much would this cost each one?

Glossary

atmosphere - the gases around the earth

compensation claims - money paid because of damage or losses

consume - to use up

decibel - a unit for measuring loudness of sounds

fuel burning engines - any engine that uses gas or oil such as those in cars, buses, and trucks

hearing loss - not being able to hear well

lungs - that part of our bodies that fills with air when we breathe

particle - a small piece of a solid object

pollutants - the things which pollute

pollute - to spoil something by improper use

refuse - garbage

sewer lines - pipes that carry liquid waste from buildings

sewage - liquid waste

smog - a mixture of air and harmful chemicals

vibrate - to move back and forth quickly

Argon, Carbon Dioxide, Carbon Monoxide, Hydrocarbons, Helium, Krypton, Neon, Nitrogen, Nitrogen Oxides, Oxygen, Sulphur Oxides - names of gases found in the air around the earth

AN ENVIRONMENTAL EDUCATION TEACHING UNIT

Consumer Ecology: Non-biodegradable Detergents and Pesticides

Level: Secondary

Developed by

Irene R. Clark

FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY

Tallahassee, Florida

TEACHING UNIT: Consumer Ecology: Non-biodegradable Detergents and Pesticides

LEVEL: Upper Elementary

GENERAL OBJECTIVES:

1. To introduce children to basic ecological relationships and principles that underlie the problems of (a) phosphate usage and the effects of phosphates on lakes and streams, and (b) the use of pesticides containing DDT and other persistent compounds.
2. To develop awareness, concern, and literacy in these areas of environmental crises which can be reflected in their future decision-making.

SPECIFIC TEACHING OBJECTIVES:

Concepts: The children will be introduced to the following--

1. Household detergents, containing phosphates, are one group of pollutants that have contributed to rapid contamination of many of our lakes and streams
2. Large amounts of persistent pesticides used on crops, weeds, and insects are the most important threat to animals in the upper soil layer and to many aquatic organisms.

Values: Upon completion of this unit, the children should be able to--

1. Develop a concerned and protective attitude toward their environment as it relates to the two concepts above.
2. Develop a value system that encourages positive action to improve the environment and protect it from contaminants.

TEACHING UNIT: Consumer Ecology (cont'd.)

In the Suggested Activities, the children will be engaging in one or more of the following General Process Skills:

1. OBSERVING
2. COLLECTING DATA
3. ORGANIZING AND INTERPRETING DATA
4. MAKING INFERENCES
5. CLASSIFYING
6. EXPERIMENTING
7. DEVELOPING CHANGE STRATEGY

INTRODUCING THE UNIT:

Have the children to name several (7-10) products which they or their parents have bought at the grocery store which may be harmful to us and our environment. Even if the products do not relate directly to the above concepts, list each of the responses on the blackboard or overhead projector with the responding child's name beside it. After compiling this list, go back and ask the responding child, "Why do you think the product is harmful?". You may hear such answers as, "Raid is poison because it says it on the label." or "Beef because you won't live a long time." or "Detergents because they're poisonous and babies might get to it." Other products might include knives,

INTRODUCING THE UNIT (cont'd.)

medicines, rat poisons, etc. Have available containers of such pesticides as Raid and detergents as Tide and/or Spic and Span. These empty packages can be used for display, for emphasizing the importance of reading labels, and for later investigating the content of non-biodegradable compounds.

Inform the children that later they will be expected to conduct surveys to find out the extent of pesticide and phosphate detergent usage in their own neighborhoods. They may also carry out experiments to test the effect of phosphates and nitrates on aquatic or water life. Finally they will be expected to suggest ways by which these environmental problems may be solved through safer alternatives.

This discussion should iniate the topic and set the stage for related activities on (a) the effect of chlorinated pesticides on our environment, and (b) the effect of phosphates and nitrates on algae growth in ponds and other bodies of water.

VOCABULARY TO BE DEVELOPED DURING ACTIVITIES:

1. algae
2. biodegradable
3. chlorinated hydrocarbons
4. DDT (dichloro-diphenyl-trichloro-ethane)
5. detergent

VOCABULARY (cont'd.)

6. eutrophication
7. nitrates
8. persistent pesticides
9. phosphates
10. synthetic compounds

SUGGESTED ACTIVITIES:

During this unit, the children (with the aid of the teacher) are to select from and participate in the following activities :

1. Carry out the long-range investigation on "How Do the Chemicals in Detergents Affect Plant Life?" (See attached copy in Appendix)
2. Reading Assignments which can be discussed in class:
   a. Silent Spring. Rachel Carson. New York: Crest. 1969. ($.95 paperback)
   b. Since Silent Spring. Frank Graham, Jr. Boston: Houghton Mifflin. 1970. ($6.95 hardback)
   c. "The Threat to Life in the Sea". Gordan Rattray Taylor. Saturday Review. 53:40-42, August 1970.
   d. "Dead Lakes: Another Washday Miracle". Consumer Reports. September, 1970.
   e. "Phosphates In Detergents". New York Times. December 15, 1969.

SUGGESTED ACTIVITIES (cont'd.)

e. "Phosphates and Nitrates", (Chapter 5). Pollution: Examining Your Environment. 1971. D. F. Wentworth, et. al. Mine Publications, Inc. 25 Groveland Terrace, Minneapolis, Minn. 55403. ($2.68 paperback).

Among the many activities on air, water, and land pollution, there are six activities on Phosphates and Nitrates.

3. Films and filmstrips for viewing:

a. "The Silent Spring of Rachel Carson"

b. "Poisons, Pests and People"

c. "The Problem with Water is People"

Each film may be ordered from:

McGraw-Hill Films
330 West 42nd Street
New York, N. Y. 10036

d. "Environmental Pollution" (a series of filmstrips including water and land pollution)

Ward's Educational Filmstrips
Ward's Natural Science Estab., Inc.
P. O. Box 1712
Rochester, N. Y. 12603

4. Near the end of unit, have classroom discussion in which the following questions are to included and discussed:

a. What are persistent pesticides and how do they eventually invade water organisms?

b. How do pesticides such as DDT affect out wildlife?

SUGGESTED ACTIVITIES (cont'd.)

c. How do phosphate detergents affect our environment and its wildlife?

d. Why are phosphorus compounds added to detergents?

e. Describe some of the events that occur during eutrophication.

f. Which pesticides or detergents would you recommend for use in our environment? Why?

5. Develop a survey data sheet and conduct a survey in your neighborhood or block by interviewing housewives to obtain the following information:

a. What brand(s) of detergents and floor cleaning products are used?

b. What is the phosphate content per cup or recommended amount for use? (May be checked at grocery)

c. Approximately how many boxes or containers are used each month?

d. Is person (housewife) aware of phosphate content and its effect?

e. What is being done in the home to reduce phosphate pollution?

6. Visit a large supermarket and check the labels on various brands of home pesticides (such as Raid). List those pesticides which contain any of the following compounds:

SUGGESTED ACTIVITIES (cont'd.)

aldrin, dieldrin, endrin, chlordane, heptochlor, toxaphene, lindan, DDT, DDD, TDE, DDVP. Beside the pesticide, list the chemical(s) from the above group which is present.

7. Make a scrapbook about various phosphate laundry detergents using cut-out front surfaces of detergent boxes. Also cut out the phosphate content information and use these for classifying your detergent collection into high, middle, and low phosphate content levels.
8. Have small groups of children to plan and develop:
   a. a counter-advertizing campaign against products with high-phosphate contents.
   b. a pro-advertizing campaign for low- or no-phosphate detergent products.

   This may include producing slogans, posters, buttons, radio and/or T. V. announcements, etc.
9. Conduct a survey to determine the kinds and brands of pesticides persons use in your neighborhood. Go to a grocery store and find out if chlorinated hydrocarbons such as DDT are present in these brands.
10. Contact local pest-control firms through the yellow pages of your telephone book and find out information on present methods they are using to control roaches, termites, ants, and other insects. Also find out what they are doing to reduce persistent pesticide pollution.

EVALUATION TECHNIQUES:

Points to keep in mind during evaluation:

1. Evaluation should be based on objectives in each area: concepts, values, and skills.
2. Evaluation should sample what has actually been taught.
3. There should be a variety of evaluation instruments and procedures involving both formal and informal techniques.
4. Promote student self-evaluation.

Sample essay items from which objective items may also be developed:

1. If you find a body of water in your area that has an excessive growth of algae, what might this indicate about the water?
2. What could you do to help fight phosphate and DDT pollution?
3. What are persistent pesticides and what effects do they have on animal life on land and in the water?
4. How do you now feel about the indiscriminant use of detergents and pesticides? How long have you felt this way?
5. What is the ecological importance of studying about detergents and pesticides?

EVALUATION TECHNIQUES (cont'd.)

6. Why was a third aquarium with no added chemical(s) used in the experiment in which you investigated the affect of the chemicals in detergents on plant life?
7. What are some steps that you followed in completing your survey on detergent and/or pesticide use in your neighborhood?

ACTIVITY: How do the chemicals in detergents affect plant life?

OBJECTIVES: To test the effects of detergent additives such as phosphates and nitrates on aquatic plant life.

MATERIALS: (per group)

aquatic plants (elodea, duckweed or other)

solid ammonium nitrate - approx. 2 teaspoons

solid potassium phosphate - approx. 2 teaspoons

3 identical large mouth jars (such as 18 oz. peanut butter jars)

clean gravel or coarse sand

masking tape for labels

petri glass covers

6 small corks

razor blade

INTRODUCTION:

Chemicals such as ammonium nitrate and potassium phosphate are often added to detergents to soften water and to help produce a cleaner, whiter wash more quickly. However, these chemicals do not completely disappear when placed in the washing machine and since they are difficult to remove from sewage they eventually find their way into our lakes and rivers, where they affect plant and other life. Yet detergents alone are not responsible for all the nitrates and phosphates in our waters. Large amounts drain from farmlands where these chemicals have been used in fertilizers, and some come from industrial waste.

ACTIVITY (cont'd.)

PROCEDURES:

1. Obtain some plants such as elodea or duckweed from a pond, aquarium, or a pet supply store.
2. Ask a druggist or high school chemistry teacher for two teaspoons of solid ammonium nitrate and two teaspoons of solid potassium phosphate.
3. Set up three identical miniture aquaria in the equal-sized glass jars. Cut slots in the corks to serve as supports for the petri dish glass covers. These will permit air to circulate while cutting down on evaporation of your water.
4. Place the same amount of water and gravel in each jar as well as the same number of plants. (Do not place any type of animal life in the aquaria.)

ACTIVITY (cont'd.)

5. Locate each aquarium in the same windowsill so that they will receive equal amounts of light.
6. Add 1/2 teaspoon of ammonium nitrate to one of the jar aquaria, and 1/2 teaspoon of potassium phosphate to the second. Do not add any chemical to the third aquarium as it will be the control.
7. Examine the aquaria each day to note any changes in plant life. Keep a diary of your observations.
8. After 3 or 4 days add another 1/2 teaspoon of each chemical.
9. Compare the two aquaria with the control and describe the differences that you see after 4 or 5 weeks.

QUESTIONS FOR CONSIDERATION:

1. Why is a control needed?
2. When did another type of green plant life first appear?
3. How did the addition of more chemical affect the rate of growth of the algae?
4. In which aquarium was the amount of algae the greatest? the least?
5. What would the growing algae do to the sunlight needed by the other algae?

AN ENVIRONMENTAL EDUCATION TEACHING UNIT

The Trans-Alaskan Pipeline and the Energy Crisis

Level: Upper Elementary

Developed by

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TEACHING UNIT: The Trans-Alaskan Pipeline and the Energy Crisis

LEVEL: Upper Elementary

GENERAL OBJECTIVES:

Upon completion of this unit, the children should:

1. Become familiar with the basic geography of Alaska and its relationship to anticipated problems and controversy in the oil pipeline construction.
2. Become aware of general background information relative to the Trans-Alaskan pipeline decision.
3. Speculate and predict possible effects of oil drilling and pipeline construction on the biological community on the Northern Slope of Alaska.
4. Become aware of methods of conserving fuel oil and other related energy sources.
5. Be able to suggest alternatives to the construction of the proposed pipeline.
6. Become sensitized to the ecological price wilderness areas generally pay for economic "progress" and industrialization.

INTRODUCTION:

Most Americans are aware of the fact that the United States is facing a serious energy problem. But the truth of the matter is, the problem is not ours alone---it involves the entire world in one way or another. (Oil and

gas now account for about 65 °/o of total world energy consumption, and this is rapidly increasing.) It is not easy to explain in brief how the crisis situation came about. Complex factors are involved---ranging from increasing crude oil consumption to disappointing new oil discoveries to environmental controversies to world political relationships.

But irrespective of why the problem exists, the fact is that the United States and other major energy-consuming countries have literally become enslaved by a non-renewable energy source for heat, transportation, electricity, and many other uses. There is fear of its depletion; for if man continues to use crude oil at its present rate, our reserves will scarely last 30 years. In the mean time, there are at least two important things we as a nation must do: (1) create a political and economic environment that will encourage energy conservation, and (2) speed the development of other conventional and nonconventional energy sources such as nuclear, solar, or geothermal energy.

Under the crisis circumstances, what "stop-gap" measures are being taken to increase our conventional oil production until new energy sources can be developed and tested?

TEACHING UNIT: INTRODUCTION (cont'd.)

The Trans-Alaskan pipeline is one such measure which has met with much environmental controversy. Crude oil is now Alaska's most valuable mineral resource. Large deposits have been discovered in the Arctic Slope Region as well as in the South Central Region around Kenai Peninsula. On November 13, 1973, Congressional approval was given for major private oil companies to build their controversial 789-mile Trans-Alaskan pipeline from Prudhoe Bay on the Northern Slope of Alaska to the southern ice-free port of Valdez. (From Valdez, the crude oil would be shipped by tankers to the lower 48 states).

The decision to build the mammoth 48-inch steel pipeline was fought by environmentalists who fear ecological damage to the tundra by the oil companies' bulldozers and drilling equipment, disruption of migration habits

of its native wildlife, oil spillage, gas leakage, and litter discarded by workmen. Environmentalists and wildlife researchers predict that caribou herds, dependent on wide-ranging migrations, may be cut off from grazing by the portion of the pipeline system which will be elevated above the ground. This was later confirmed in results from the construction of a simulated pipeline in order to test if caribou would cross under.

Past arctic explorations reveal that, when damaged by motor vehicle tracks and drilling rigs, the tundra does not heal for decades from its scars. Further damage is expected from thawing of the permafrost as hot 170° F. oil (heated by friction) flows through the icy climate. Also anticipated is the compounded damage to the land by earthquakes which are fairly common in Alaska. How can disastrous oil spills be prevented if breakage should occur in such a massive pipeline system transporting over 400,000 gallons of oil per mile? How can this Arctic wilderness be protected? An extremely fragile ecology is involved and no one really knows what will be the ultimate impact of the pipeline on the Alaskan landscape along with its plant and animal communities.

With the U. S. consuming 17 million barrels of oil daily and the world oil usage doubling during the 1970's,

the governmental administration and major oil companies insist that our fuel shortage is so critical that the oil deposits of Alaska (amounting to 10 billion barrels or more) must be tapped and utilized no matter what the ecological price and no matter what the trade-offs are.

VOCABULARY TO BE DEVELOPED DURING ACTIVITIES:

1. Arctic
2. arctic desert
3. caribou
4. coastal plain
5. conservation (of energy)
6. crude oil
7. diameter
8. Eskimo
9. inland
10. insulation
11. migration (of caribou)
12. Northern Slope
13. permafrost
14. refining (of oil)
15. rig
16. tundra

STUDENT ACTIVITIES:

1. Have students to read one or all of the following:
   a. "Kiss the North Slope Good-by?" by George Laycock. Audubon, Sept. 1970. pp. 68-75.
   b. "North Slope: Oil Rush". Science, Vol. 166, Oct. 3, 1969. pp. 85-89.
   c. "Now, a Change in Wasteful Habits". Time, Oct. 29, 1973. p. 51.

TEACHING UNIT: STUDENT ACTIVITIES (cont'd.)

2. Discuss the essence of the above articles based on the following suggested questions:

   a. Why is the coastal area around Prudhoe Bay called "the North Slope"?

   b. In what part of Alaska is Prudhoe Bay? Valdez? How do these two areas differ in climate?

   c. In which general direction will the pipeline flow?

   d. What are some major climatic characteristics of the Arctic Tundra? plant and animal characteristics?

   e. What anticipated problems will the pipeline pose for:

      (1) the land itself?

      (2) the wildlife?

      (3) the land owners?

   f. What are some alternatives to the proposed pipeline as methods of removing crude oil from Alaska?

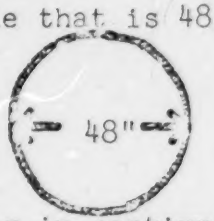
   g. Which is more important to you and why?

      (1) the wild barren character of the open tundra of Alaska and its protection

      (2) the right to remove the Alaskan crude oil deposits and the possible consequences.

   h. What are some ways by which we as consumers can conserve energy and lessen the demand in (1) home heating, (2) transportation, and (3) electricity?

3. The proposed pipeline is to be a mammoth 48-inch (in diameter) steel pipe across Alaska. On the blackboard, draw a circle that is 48 inches across.



How long is this diameter in centimeters (cm)? _____

How tall are you in cm? _____

Could you easily move about in such a pipeline? ____

Locate 2 or more objects in the classroom that are nearly 48 inches in height. _____

_____

4. Heat a pan of water to 170° F (approx. 77°C). Check the temperature carefully using a thermometer. Does the water boil? _____ Does it steam? _____ Is it very warm to the touch? _____. If the flowing oil should reach the temperature of 170° F or higher due to friction within the pipeline, how will this affect the surrounding tundra? _____

_____

5. Collect pictures and/or descriptions of some of the types of animal wildlife found in Northern Alaska. How could these animals be affected by the pipeline?

6. Collect pictures (and maybe even some live samples such as lichens or mosses) of types of plant life

found in Alaska.

7. Attempt to locate a sample of crude oil. Also collect and mount for display, at least 10 or more sample products made from crude oil. (Be very cautious and label those products which may be harmful or highly combustible.)
8. Develop posters and/or write a short paper on "How to Reduce and Prevent Waste of Crude Oil Products" (such as gasoline, home fuel oil, etc.).
9. What are some energy sources other than oil that are being considered and investigated for major use in the future?